Implications of Chemical Mixtures in Public Health Practice

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Goal and Scope. The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency that investigates and strives to prevent human health problems caused by exposure to toxic chemicals and their mixtures in the environment. Most human exposures involving toxic chemicals or mixtures are thought to originate from environmental sources; however, concurrent exposures are also likely from other sources, such as prescription and nonprescription drugs, indoor air pollutants, and tobacco smoke. Thus, in evaluating the potential hazard following exposure to environmental mixtures, ATSDR not only considers the inherent joint toxicity of the mixture but also the influence of environmental, demographic, occupational, and lifestyle factors.

Methods. To foster these goals, ATSDR has developed a Mixtures Research and Assessment Program that consists of three component efforts: trend analysis, joint toxicity assessment, and experimental testing. Through trend analysis, ATSDR prioritizes environmental mixtures of concern for which assessments need to be conducted. If data are not available to conduct appropriate assessments, an experimental research agenda is pursued through established extramural mechanisms. The experimental studies supported by ATSDR include dose-response and mechanistic studies. Insights gained from both in vivo and in vitro experiments are used to improve toxicity testing and assessment methods. Ultimately, the data generated are used to support ATSDR's mission of evaluating the influence of environmental chemicals on human health and means to mitigate it. This pragmatic approach allows testable hypotheses or research needs to be identified and resolved and enhances our understanding of the mechanisms of joint toxicity. Several collaborative and cooperative efforts with national and international organizations such as the TNO, the Netherlands, and the Department of Energy are being pursued as part of these activities.

Results and Conclusions. ATSDR has (1) identified mixtures of environmental chemicals that should be studied, (2) identified and prioritized data gaps, and (3) funded research to fill some of the priority data gaps. Body burdens of some of the environmental chemicals have been determined in human populations and trends will be established for several additional chemicals. Results from in vitro studies using techniques such as microarray give critical information that can be used to determine exposures to chemicals. All chemical mixtures cannot be tested hence computational tools need to be developed and increasingly employed.

Recommendations and Outlook. At the agency level, the need for studies on chemical mixtures has been elevated to one of six priority research areas in environmental public health. This has been reinforced through ATSDR's close work with communities whose leaders have spoken passionately about their concern for information on exposures to chemical mixtures. The agency also works closely with other federal agencies such as the U.S. Environmental Protection Agency, the National Institute for Occupational Safety and Health and the Department of Energy to provide its insights in the areas of mixtures exposures, and testing and research applications to solve environmental toxicology problems.